

What Is Claimed Is:

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CLAIM 1

1 1. A method for maximizing satellite con-
2 stellation coverage at predetermined local times for a
3 set of predetermined geographic locations, the method
4 comprising:

5 determining a satellite constellation having
6 a first coverage, the constellation including at least
7 one desired satellite wherein each of the at least one
8 desired satellites have a trajectory associated there-
9 with;

10 determining a period of rotation for each of
11 the desired satellites;

12 determining a time dependent coverage of the
13 satellite constellation based on the period of rotation
14 and the trajectory of each of the desired satellites;

15 tilting the trajectory of at least one of the
16 desired satellites to obtain a second coverage based on
17 the time dependent coverage, the second coverage provid-
18 ing maximum coverage at the predetermined local times
19 for the set of predetermined geographic locations; and

20 generating command signals for modifying the
21 trajectory of the at least one desired satellite.

1 2. The method as recited in claim 1 wherein
2 generating the command signals includes programming a
3 computer with orbital parameters based on the tilted
4 trajectory.

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CLAIM 2

1 3. The method as recited in claim 2 further
2 comprising launching the at least one desired satellite
3 with the orbital parameters programmed therein.

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1 4. The method as recited in claim 1 wherein
2 generating the command signals includes transmitting the
3 command signals to the at least one desired satellite.

1 5. The method as recited in claim 1 wherein
2 determining the period of rotation includes determining
3 if the trajectory of the at least one desired satellite
4 is equatorial.

1 6. The method as recited in claim 5 wherein
2 determining the period includes determining the period
3 of rotation according to the following if the trajectory
4 is equatorial:

$$P = [m_s D_s D_N / (n D_N + m_s D_s)],$$

6 where,

7 P is the orbit period with its sign indicating
8 whether it is a direct or retrograde orbit;

9 n is an integer with its absolute value equal
10 to the number of times that the satellite transverses
11 the same geographic longitude within the repeating
12 period;

13 m_s is the number of mean solar day per repeat-
14 ing period and must be a positive integer relatively
15 prime to n;

16 D_s is the mean solar day, which is 24 hours or
17 1440 minutes; and

18 D_N is the nodal day which is the period of the
19 earth-rotation relative to the ascending node or any
20 point of the orbit plane.

1 7. The method as recited in claim 5 wherein
2 determining the period includes determining the period
3 of rotation according to the following if the trajectory
4 is not equatorial:

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$$P = \frac{T}{n+m_N}$$

5 where,
6 m_N is the number of nodal day per repeating
7 period which must be a positive integer relatively prime
8 to n ; and
9 T is the repeating period that the coverage
10 pattern starts to repeat itself.

1 8. The method as recited in claim 1 wherein
2 determining the time dependent coverage includes per-
3 forming a simulation.

1 9. The method as recited in claim 1 wherein
2 the trajectory is defined by a first coordinate system
3 and wherein tilting the trajectory comprises:
4 translating the first coordinate system into
5 rotation matrices;
6 transforming the rotation matrices based on
7 the tilting; and
8 determining a second coordinate system based
9 on the transformed rotation matrices.

1 10. A system for maximizing satellite con-
2 stellations coverage at predetermined local times for a
3 set of predetermined geographic locations, the satellite
4 constellation having a first coverage and including at
5 least one desired satellite wherein each of the at least
6 one desired satellites have a trajectory associated
7 therewith, the system comprising:
8 a processor operative to determine a period of
9 rotation for each of the desired satellites, determine
10 a time dependent coverage of the satellite constellation
11 based on the period of rotation and the trajectory of

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12 each of the desired satellites, and to tilt the trajec-
13 tory of at least one of the desired satellites to obtain
14 a second coverage based on the time dependent coverage,
15 the second coverage providing maximum coverage at the
16 predetermined local times for the set of predetermined
17 geographic locations; and
18 means for generating command signals for
19 modifying the trajectory of the at least one desired
20 satellite.

1 11. The system as recited in claim 10 wherein
2 the means for generating is a computer programmed to
3 launch the at least one desired satellite into space
4 with the modified trajectory.

1 12. The system as recited in claim 11 wherein
2 the trajectory is a theoretical trajectory.

1 13. The system as recited in claim 10 wherein
2 the means for generating is a satellite ground station
3 operative to transmit and receive signals to and from
4 the at least one desired satellite.

1 14. The system as recited in claim 13 wherein
2 the trajectory is an actual trajectory.

1 15. The system as recited in claim 10 wherein
2 the processor, in determining the period of rotation, is
3 further provided for determining if the trajectory of
4 the at least one desired satellite is equatorial.

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1 16. The system as recited in claim 15 wherein
2 the processor, in determining the period, is further
3 operative to determine the period of rotation according
4 to the following if the trajectory is equatorial:

$$P = [m_s D_s D_N / (n D_N + m_s D_s)],$$

5 where,

6 P is the orbit period with its sign indicating
7 whether it is a direct or retrograde orbit;

8 n is an integer with its absolute value equal
9 to the number of times that the satellite transverses
10 the same geographic longitude within the repeating
11 period;

12 m_s is the number of mean solar day per repeat-
13 ing period and must be a positive integer relatively
14 prime to n;

15 D_s is the mean solar day, which is 24 hours or
16 1440 minutes; and

17 D_N is the nodal day which is the period of the
18 earth-rotation relative to the ascending node or any
19 point of the orbit plane.
20

1 17. The system as recited in claim 15 wherein
2 the processor, in determining the period, is further
3 operative to determine the period of rotation according
4 to the following if the trajectory is not equatorial:

$$P = \frac{T}{n+m_N}$$

5 where,

6 m_N is the number of nodal day per repeating
7 period which must be a positive integer relatively prime
8 to n; and

9 T is the repeating period that the coverage
10 pattern starts to repeat itself.

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1 18. The system as recited in claim 10 wherein
2 the processor, in determining the time dependent cover-
3 age, is further operative to perform a simulation.

1 19. The system as recited in claim 10 wherein
2 the trajectory is defined by a first coordinate system
3 and wherein the processor, in tilting the trajectory, is
4 further operative to translate the first coordinate
5 system into rotation matrices, transform the rotation
6 matrices based on the tilting, and determine a second
7 coordinate system based on the transformed rotation
8 matrices.

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